

**PATENT ABSTRACTS OF JAPAN**

(11)Publication number : 2002-047430

(43)Date of publication of application : 12.02.2002

(51)Int.Cl.

C08L101/06  
C08K 5/103  
C08K 5/42  
C08L 61/08  
C09D 5/32  
C09D161/08  
C09D201/00  
G03F 7/11

Best Available Copy

(21)Application number : 2001-125683

(71)Applicant : SHIPLEY CO LLC

(22)Date of filing : 24.04.2001

(72)Inventor : RUTTER EDWARD W JR  
TREFONAS PETER III  
PAVELCHEK EDWARD K

(30)Priority

Priority number : 2000 556542 Priority date : 24.04.2000 Priority country : US

**(54) COMPOSITION FOR FILLING APERTURE**

(57)Abstract:

**PROBLEM TO BE SOLVED:** To obtain a composition for filling apertures which can provide a substantially and locally flat, aperture surface, and is more excellent in efficiency for filling a gap and etching resistance than a known composition.

**SOLUTION:** This composition comprises one or more crosslinkable polymers each having a weight-average molecular weight of about 8,000 or less and an Mw/Mn value of at least 1.5, one or more acid catalysts, one or more crosslinking agents, and one or more solvents, wherein the crosslinkable polymers contain each a monomer having at least one hydroxyl group as a polymerization unit, the hydroxyl group being of at least about 3 wt.% relatively to the crosslinkable polymers.

**LEGAL STATUS**

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] Said constituent further whose polymer for which this hydroxyl can construct [ this ] a bridge it is the constituent which contains one or more solvents in 1 or more [ which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 / of the polymer for which a bridge can be constructed ], and 1 or more acid catalysts, one or more cross linking agents, and a list, and is about 3 % of the weight at least including the monomer in which the polymer in which this bridge formation is possible has at least one hydroxyl as a polymerization unit.

[Claim 2] The constituent according to claim 1 with which one or more solvents have the boiling point 170 degrees C or more.

[Claim 3] The constituent according to claim 1 whose Mw/Mn value is at least 2.0.

[Claim 4] The constituent according to claim 1 whose Mw/Mn value is at least 2.5.

[Claim 5] The constituent according to claim 1 which are about 5 of a polymer over which hydroxyl can construct a bridge - 25 % of the weight of abbreviation.

[Claim 6] The constituent according to claim 1 with which the polymer which can construct a bridge has about 5000 or less weight average molecular weight.

[Claim 7] The constituent according to claim 1 with which the polymer which can construct a bridge contains one or more aromatic compounds as a polymerization unit.

[Claim 8] The constituent of all polymerization units according to claim 7 which contains about 20% of the weight of an aromatic compound at least.

[Claim 9] The constituent according to claim 1 which contains one or more plasticizers further.

[Claim 10] The constituent according to claim 9 whose plasticizer is 2 base ester.

[Claim 11] The constituent according to claim 9 with which one or more plasticizers exist in the amount of 0.5 - 100% of abbreviation of solid content.

[Claim 12] The constituent according to claim 1 whose cross linking agent the polymer which can construct a bridge is an aromatic aldehyde condensation product, it is dodecylbenzenesulfonic acid with which the acid catalyst was blocked, and is tetra-butoxy glycoluril and whose solvent is propylene-glycol-monomethyl-ether acetate further.

[Claim 13] How to protect the bottom product of aperture in the manufacture including the process which heats this base of an electron device at sufficient temperature to arrange a constituent according to claim 1 on the front face of the base which has aperture, and harden this constituent selectively at least to; pan.

[Claim 14] The base which is what has the constituent with which aperture contains the constituent of claim 1 and which has said aperture.

[Claim 15] One or more [ of the polymer in which aperture has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 and for which a bridge can be constructed ] It has a constituent containing one or more [ which contains one or more cross linking agents in a list as a polymerization unit / over which the bridge was constructed / of a polymer ]. The base which has said aperture whose polymer over which this hydroxyl can further construct a bridge is about 3 % of the weight at least including the monomer in which the polymer in which this bridge formation is possible has at least one hydroxyl as a polymerization unit.

[Claim 16] One or more [ which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 / of the polymer for which a bridge can be constructed ] It is the constituent which contains one or more solvents in one or more acid catalysts, one or more cross linking agents, and a list. The polymer in which

this bridge formation is possible as a polymerization unit Said constituent of further the polymer for which this hydroxyl can construct [ this ] a bridge which is about 3 % of the weight at least including the monomer which has at least one hydroxyl The method including the process which hardens this constituent selectively at least by heating this base at sufficient temperature arranging on the front face of a base and hardening this constituent selectively at least to; pan of offering the front face by which flattening was carried out substantially.

[Claim 17] The approach according to claim 16 of including further heating a base at temperature sufficient before hardening a constituent selectively at least carrying out a reflow of this constituent.

[Claim 18] The approach according to claim 16 a solvent has the boiling point 170 degrees C or more.

[Claim 19] The approach according to claim 16 a Mw/Mn value is at least 2.0.

[Claim 20] The approach according to claim 16 a Mw/Mn value is at least 2.5.

[Claim 21] The approach according to claim 16 hydroxyls are about 5 of the polymer which can construct a bridge - 25 % of the weight of abbreviation.

[Claim 22] The approach according to claim 16 the polymer which can construct a bridge has about 5000 or less weight average molecular weight.

[Claim 23] The approach according to claim 16 the polymer which can construct a bridge contains one or more aromatic compounds as a monomeric unit.

[Claim 24] The approach of all monomeric units according to claim 23 which contains about 20% of the weight of an aromatic compound at least.

[Claim 25] a) the 1st two or more aperture -- a base -- providing --;b -- the polymer which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 and for which a bridge can be constructed one or more It is a constituent for aperture restoration containing one or more acid catalysts, one or more cross linking agents, and one or more solvents. The polymer in which this bridge formation is possible is said constituent for aperture restoration further whose polymer for which this hydroxyl can construct [ this ] a bridge is about 3 % of the weight at least including the monomer which has at least one hydroxyl as a polymerization unit. this, although it is selectively filled up with the 1st two or more aperture at least and a;c this constituent is hardened selectively at least sufficient temperature -- this base -- heating --;d -- the structure which connects the 1st two or more aperture with which it filled up selectively at least -- plasma etching -- carrying out --; -- further -- e -- the constituent hardened selectively at least this -- the method including the process removed from the 1st two or more aperture of manufacturing an electron device.

[Claim 26] The approach according to claim 25 of including further the process which arranges antireflection coating on the front face of the constituent for aperture restoration.

[Claim 27] The approach according to claim 25 by which the etch rate of the constituent for aperture restoration and a base conforms substantially.

[Claim 28] One or more [ which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 on the front face of the base which has aperture in a layer / of the polymer for which a bridge can be constructed ] It is the constituent for aperture restoration which contains one or more solvents in one or more acid catalysts, one or more cross linking agents, and a list. The polymer in which this bridge formation is possible contains the monomer which has at least one hydroxyl as a polymerization unit. The polymer for which this hydroxyl can construct [ this ] a bridge is about 3 % of the weight at least. At least one of the polymer in which this bridge formation is possible, and these the cross linking agents contains an aromatic series monomer as a polymerization unit. At least one of the polymer in which this bridge formation is still more possible, and these the cross linking agents contains an aliphatic series monomer as a polymerization unit. Although said constituent for aperture restoration is arranged and this constituent is selectively hardened at least to; pan How to protect the bottom product of aperture in the manufacture of an electron device to which the plasma-etching rate of; this constituent for aperture restoration and the plasma-etching rate of the layer which has aperture conform substantially including the process which heats this base at sufficient temperature.

[Claim 29] The base which has in a layer said one or more aperture to which it has the constituent for aperture restoration with which one or more aperture contains the polymer over which the bridge was constructed, and the plasma-etching rate of the polymer over which the bridge was this constructed, and the plasma-etching rate of the layer which has aperture conform substantially.

---

[Translation done.]

**\* NOTICES \***

**JPO and NCIPi are not responsible for any damages caused by the use of this translation.**

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

**DETAILED DESCRIPTION**

---

**[Detailed Description of the Invention]**

[0001] This invention relates to the field of manufacture of an electron device generally. About flattening of the base used for manufacture of an electron device, especially this invention is divided and relates to restoration of aperture (apertures). In manufacture of electron devices including a printed wired board or a semi-conductor, the layer of the matter of many including a photoresist or antireflection coating is applied to a base. In a specific case, the layer applied is wanted to follow in footsteps of a base, but in other cases, it is desired for the layer applied to be flat. Difficulty may arise in patterning of the upper layer in the integrated-circuit structure which has topography (topography) with a substantial lower layer especially. One of the difficulty in such patterning is perpendicular IKUSUKASHON (excursion) which can have substantial effect. For example, fluctuation of a perpendicular direction (1 or 2 microns) is possible. Since perpendicular IKUSUKASHON can take the available depth of focus, fluctuation of such a perpendicular direction makes it difficult to double the focus of an optical pattern. In order to raise the possible depth of focus potentially, it is advantageous to arrange all photoresist layers in the same height, or to carry out flattening in such a situation.

[0002] One of the approaches of arranging a photoresist in the height same on a base is indicated by U.S. Pat. No. 4557797 (Fuller et al.), the multilayer-structure object which has the comparatively thick lower layer of Pori (methylmetaacrylate) (PMMA) is used for this approach, and it offers a flat front face, the thin middle class who is antireflection coating, and the thin upper layer which is the photoresist matter. However, this system forms as a result the thick polymer layer which must be removed. Typically, such a layer is removed by various approaches including chemical machinery polish (CMP), etching, and wet chemical \*\*. For the time amount of the addition by such clearance process, and cost, in order that a polymer layer may help subsequent clearance, a thing thin as much as possible is desired. Specific antireflection coating is itself, and it can carry out flattening of the front face of a base so that it may enough enable the effective activity of a photoresist. For example, Adams et al., Planarizing AR for DUV Lithography, Microlithography 1999:Advances in Resist Technology and Processing XVI, Proceedings of SPIE vol.3678, part2 and pp 849-856, 1999 reference. However, it is not indicated that such antireflection coating is thoroughly filled up with aperture including Bahia and a trench, and it has low gap-filling ability from whenever [ comparatively low etching-proof nature and middle ]. The bottom product of Bahia is important for etching-proof nature in the dual DAMASHIN (dual damascene) process which needs to be protected between etching of a trench. Current antireflection coating does not have sufficient resistance from which the bottom product of Bahia is protected, while not having sufficient gap-filling ability to be thoroughly filled up with the bottom product of the small structure, especially the structure of sub-quarter micron size and etching a trench to such an etching process.

[0003] U.S. Pat. No. 5976703 (Nakata et al.) indicates the flattening layer for a printed wired board base. A copolymer with the ORGANO siloxane (organosiloxane) of the poly sill phenylene siloxane (polysilphenylenesiloxane) or the poly sill phenylene siloxane is used for such a flattening layer. These polymers can carry out flattening of the structure which has the geometry of the range of 10 - 100 micrometers of numbers. Such a polymer is not indicated about the activity in semi-conductor manufacture, but further, in the engine performance, it is limited so that a subsequent processing process [ as / in a dual DAMASHIN manufacture process ] may be borne. Therefore, the need of offering the quality of aperture packing which has sufficient etching-proof nature to protect the bottom product of the structure (features) continues and exists between the front face by which flattening was carried out, and a next processing process.

[0004] This invention provided the surprising thing with surface substantial local flattening which used more

nearly little over coating, and having the gap-filling ability and the outstanding etching-proof nature superior to a well-known constituent was found out. Moreover, it was found out by the surprising thing that this invention offers protection of the structure between next processing processes and the bottom product of especially small aperture. Therefore, this invention is useful especially in manufacture of the semi-conductor which used the dual DAMASHIN process. One or more [ of the polymer (cross-linkable) in which this invention has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 in the 1st mode and for which a bridge can be constructed ] One or more acid catalysts, one or more cross linking agents, and one or more solvents are included. The polymer in which this bridge formation is possible as a polymerization unit The constituent of further the polymer for which this hydroxyl can construct [ this ] a bridge which is about 3 % of the weight at least is offered including the monomer which has at least one hydroxyl.

[0005] In the 2nd mode, this invention offers the base which is what has the constituent with which aperture contains said constituent and which has said aperture. the 3rd voice -- the front-face top of the base with which it sets like and this invention has aperture -- said constituent -- arranging --; -- the approach of protecting the bottom product including the process which heats a base at sufficient temperature to stiffen this constituent selectively further at least of aperture in manufacture of an electron device is offered. In the 4th mode, this invention is a base which has aperture. This aperture as a polymerization unit One or more [ which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 / of the polymer for which a bridge can be constructed ] It has a constituent containing one or more [ which contains one or more cross linking agents in a list / over which the bridge was constructed / of a polymer ]. The polymer in which this bridge formation is possible offers the base whose polymer over which this hydroxyl can further construct a bridge is about 3 % of the weight at least and which has said aperture including the monomer which has at least one hydroxyl as a polymerization unit.

[0006] One or more [ of the polymer to which this invention has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 on the front face of a base in the 5th mode and for which a bridge can be constructed ] It is the constituent which contains one or more solvents in one or more acid catalysts, one or more cross linking agents, and a list. The polymer in which this bridge formation is possible contains the monomer which has at least one hydroxyl as a polymerization unit. At sufficient temperature to arrange said constituent whose polymer over which this hydroxyl can construct a bridge is about 3 % of the weight at least, and harden this constituent selectively at least to; pan By heating this base, the method including the process which hardens this constituent selectively at least of offering the front face by which flattening was carried out substantially is offered. The 1st two or more aperture is selectively filled up with the constituent for aperture restoration at least. the 6th voice -- like -- setting -- this invention -- the 1st aperture beyond :a2 -- a base -- providing --;b -- this -- One or more [ in which this constituent for aperture restoration has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 / of the polymer for which a bridge can be constructed ] The polymer in which this bridge formation is possible contains the monomer which has at least one hydroxyl as a polymerization unit including one or more acid catalysts, one or more cross linking agents, and one or more solvents. Although further the polymer for which this hydroxyl can construct [ this ] a bridge is about 3 % of the weight at least and a;c this constituent is hardened selectively at least sufficient temperature -- this base -- heating --;d -- the structure which connects two or more [ of the 1st aperture with which it filled up selectively at least ] -- plasma etching -- carrying out --; -- further -- e -- the constituent hardened selectively at least this -- the method including the process removed from the 1st two or more aperture of manufacturing an electron device is offered.

[0007] In the 7th mode, this invention on the front face of the base which has aperture in a layer One or more [ which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 / of the polymer for which a bridge can be constructed ] It is a constituent for aperture restoration containing one or more acid catalysts, one or more cross linking agents, and one or more solvents. The polymer in which this bridge formation is possible contains the monomer which has at least one hydroxyl as a polymerization unit. The polymer for which this hydroxyl can construct [ this ] a bridge is about 3 % of the weight at least. At least one of the polymer in which this bridge formation is possible, and these the cross linking agents contains an aromatic series monomer as a polymerization unit. At least one of the polymer in which this bridge formation is still more possible, and these the cross linking agents contains an aliphatic series monomer as a polymerization unit. The plasma-etching rate of; this constituent for aperture restoration and the plasma-etching rate of an

aperture content layer conform substantially including the process which heats this base at sufficient temperature to arrange said constituent for aperture restoration and harden this constituent selectively at least to; pan. The approach of protecting the bottom product of aperture in manufacture of an electron device is offered. the 8th voice -- the base with which it sets like and this invention has aperture one or more in a layer -- it is -- this -- said base with which it has a constituent for aperture restoration containing the polymer by which the bridge was constructed over one or more aperture, and the plasma-etching rate of the polymer over which the bridge was this constructed, and the plasma-etching rate of the layer which has aperture conform substantially is offered.

[0008] :degree-C= Celsius degree;g= gram;cm= cm;nm= nano meter;\*= angstrom to which the following abbreviation has the semantics of a degree as what is used through this description unless it is shown especially in others; it is a rotational frequency around for [ %wt= percentage-by-weight;L= liter;mL= milliliter; and rpm= ] 1 minute. The vocabulary "a polymer" means a dimer, a trimer, a tetramer, oligomer, a homopolymer, a copolymer, etc. Both acrylate and methacrylate are further included [ vocabulary / "an acrylic (meta)" ] with the vocabulary "acrylate (meta)" including both an acrylic and a meta-acrylic. Similarly, the vocabulary "acrylamide (meta)" means both acrylamide and meta-acrylamide. "Alkyl" contains a straight chain, branched chain, and a ring type alkyl group. A "cross linker" and a "cross linking agent" are used exchangeable in this description. The vocabulary "a monomer" means the ethylene nature or the acetylene nature unsaturated compound by which a polymerization can be carried out. "Aperture" means Bahia, trenches, and such combination. The "structure" means various geometry and aperture is included. Unless it is shown especially in others, all amounts are percentage by weight and all ratios are weight ratios. Combination is possible for all numerical range including a boundary value.

[0009] This invention relates to offering the base which has a flat front face locally substantially. This invention relates also to offering the base which has the aperture protected from a next etching process. For the base which has the structure, this invention offers the aperture with which offered the flat front face substantially and it filled up still more nearly substantially on all the structures. This invention is suitable for especially being filled up with aperture including Bahia in the dual DAMASHIN process in manufacture of a semi-conductor. The constituent of this invention useful as the constituent for flattening and the constituent for aperture restoration, especially a constituent for the Bahia restoration 1 or more [ which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 / of the polymer for which a bridge can be constructed ], and 1 or more acid catalysts, one or more cross linking agents, and one or more solvents are included. The polymer in which this bridge formation is possible as a polymerization unit Even if there are few polymers over which this hydroxyl can construct a bridge further including MONOMA \*\* which has at least one hydroxyl, it is about 3 % of the weight. As for the polymer which can construct a bridge, it is desirable to have about 5000 or less weight average molecular weight, and it is about 3000 or less more preferably. Moreover, it is desirable to have about 300 weight average molecular weight at least, it is about 400 at least preferably, and the polymer which can construct a bridge is about 500 at least more preferably. Therefore, especially the range of useful weight average molecular weight is about 300 - abbreviation 5000.

[0010] The polymer which can construct a bridge for this invention is low molecular weight, and has large molecular weight distribution. the molecular weight distribution of this invention are characterized with the ratio (Mw/Mn) to degree of dispersion of a polymer, i.e., the number average molecular weight of weight average molecular weight, -- having -- the polymer of this invention -- typical -- the Mw/Mn value of at least 1.5, i.e., degree of dispersion, -- having -- desirable -- at least 1.8 -- more -- desirable -- at least 2.0 -- further -- more -- desirable -- at least 2.5 -- further -- more -- desirable -- at least 3.0 -- it is at least 3.5 most preferably. typical degree of dispersion of the polymer in which such bridge formation is possible -- the range of 1.5-4 -- it is -- desirable -- 1.8-4 -- it is 2-4 more preferably. The polymer of this invention contains the monomer which has one or more hydroxyls as a polymerization unit. Such a monomer can be aliphatic series or aromatic series, and can contain other functional groups. The monomer which has such hydroxyl is understood to be what can have 1, 2, 3, 4, or the hydroxyl beyond it. The polymer which can construct a bridge is desirable about 3% of the weight at least, and hydroxyl is more preferably contained at about 8 % of the weight at least about 5% of the weight. Especially the polymer in which useful bridge formation is possible has the hydroxyl of about 3 - 25 % of the weight of abbreviation.

[0011] Although the polymer of the arbitration which contains an aromatic aldehyde condensation product and



the monomer which has one or more hydroxyls as a polymerization unit as a polymer in which suitable bridge formation is possible is mentioned, it is not limited to this. Although phenol novolak resin is mentioned as a useful aromatic series-aldehyde condensation product in this invention, it is not limited to this. Such novolak resin is typically prepared by condensation with the aldehyde of a phenol, this novolak resin is still better known, and it is Kirk. Othmer Encyclopedia of It is indicated by many periodicals containing Chemical Technology, 15 volumes, 176-208 pages, and 1968, and the publication which teaches such resin in this periodical is referred to as some of these descriptions. Although a phenol is a phenol generally because of itself formation of such phenol resin used, and not limited especially for example, other hydroxy permutation aromatic compounds like bisphenols including p-phenylphenol and 4, and 4'-isopropylidene diphenol are suitable for alkylation phenol; lists including a resorcinol; gallic-acid; naphthol, cresol, a xylene, and p-tert-butylphenol similarly. Cresol is mentioned as a desirable phenol and such mixture is more preferably mentioned to m-cresol, m- and the mixture of p-cresol, 2, 5-xylene, and a list. The mixture of a hydroxy permutation aromatic compound can be advantageously used in this invention.

[0012] Although the aldehyde used is formaldehyde typically, and not limited to other aldehydes, for example, these, an acetaldehyde, furfuraldehyde (furfuraldehyde), and aromatic aldehyde can be used. Desirable aromatic aldehyde has hydroxyl in an alt.location to a carbonyl group. The most desirable aromatic aldehyde is salicylaldehyde, benzaldehydes, and such mixture. As other suitable aromatic aldehyde for the object of this invention, 2-chlorobenzaldehyde, a 3-hydroxy benzaldehyde, a 4-hydroxy benzaldehyde, 2-methoxy benzaldehyde, 3-nitro benzaldehyde, etc. are mentioned. The mixture of an aldehyde can be advantageously used in this invention. When aromatic aldehyde is mixed with formaldehyde precursors including formaldehyde or a paraformaldehyde, aromatic aldehyde exists exceeding the number of mols of formaldehyde, and is a thing of aldehyde mixture which exists at about 90 % of the weight at least more preferably.

[0013] Typically, phenol novolak resin is formed by condensing a phenol, i.e., a hydroxy-permutation aromatic compound, under an aldehyde and existence of an acid. Although mol concentration of an aldehyde can be slightly lessened rather than the mol concentration of a phenol, it can also exist in the equivalent or the slightly superfluous amount of a phenol, without making the resin over which the bridge was constructed form. At this point, the ratio to the aldehyde of a phenol can change from about 1.1 to 1.0 to 1.0 to 1.1. Refer to U.S. Pat. No. 5939511 (Zampini et al.). Generally, in this invention, degree of dispersion of such an aromatic series-aldehyde condensation product useful as a polymer which can construct a bridge is about 2.5 at least, is about 3.0 at least preferably, and is about 3.5 at least more preferably.

[0014] The ethylene nature which has the hydroxyl of arbitration, or an acetylene nature unsaturated compound is useful as a monomer which has the hydroxyl in this invention. The monomer which has such hydroxyl can be aliphatic series or aromatic series. As a monomer which has suitable hydroxyl A phenol, cresol, resorcinol, pyrogallol, a methylol phenol, Methylol cresol, methylol resorcinol, methylol pyrogallol, A hydroxyethyl phenol, a hydroxypropyl phenol, hydroxyethyl cresol, A vinyl phenol, vinyl cresol, a vinyl methoxy phenol, Hydroxyethyl (meta) acrylate, 2-hydroxypropyl (meta) acrylate, To 3-hydroxypropyl (meta) acrylate and hydroxy cyclo, KISHIRU (meta) acrylate, Hydroxyphenyl (meta) acrylate, G ethylene glycol (meta) acrylate, Screw (hydroxyethyl) itaconate, screw (hydroxyethyl) citraconate, Although screw (hydroxyethyl) fumarate, hydroxyethyl itaconate, an allyl compound phenol, an allyl compound methoxy phenol, allyl alcohol, vinyl alcohol, etc. are mentioned, it is not limited to these. Although an acrylic acid (meta), acrylamide (meta), alkyl (meta) acrylate, alkenyl (meta) acrylate, aromatic series (meta) acrylate, a vinyl aromatic series monomer, nitrogen content compounds and these thio-analogs, a permutation ethylene monomer, etc. are mentioned to combination with the monomer which has the hydroxyl of this invention as a useful suitable monomer, it is not limited to these.

[0015] Typically, in this invention, useful alkyl (meta) acrylate is alkyl (C1-C24) (meta) acrylate. As suitable alkyl (meta) acrylate, although "low cut (low cut)" alkyl (meta) acrylate, "mid cut (mid cut)" alkyl (meta) acrylate, and "high cut (high cut)" alkyl (meta) acrylate are mentioned, it is not limited to these. Typically, as for "low cut" alkyl (meta) acrylate, an alkyl group has 1-6 carbon atoms. As suitable low cut alkyl (meta) acrylate, although it passes, and KISHIRU methacrylate is mentioned to KISHIRU methacrylate and cyclo and KISHIRU acrylate and such mixture are mentioned to cyclo, they are not a methylmethacrylate (MMA), methyl acrylate, ethyl acrylate, propyl methacrylate, butyl methacrylate (BMA), butyl acrylate (BA), isobutyl methacrylate (IBMA), and the thing limited to these.

[0016] Typically, as for "mid cut" alkyl (meta) acrylate, an alkyl group has 7-15 carbon atoms. As suitable mid cut alkyl (meta) acrylate To 2-ethyl to KISHIRU acrylate (EHA) and 2-ethyl KISHIRU methacrylate, Octyl methacrylate, decyl methacrylate, isodecyl methacrylate (it IDMA(s)) The undecyl methacrylate which uses branching (C10) alkyl isomer mixture as the base, Dodecyl methacrylate (known also as lauryl methacrylate), Although methacrylate, tetradecyl methacrylate (known also as milli still methacrylate), pentadecyl methacrylate, and such mixture are mentioned, it is not limited to these. As useful mixture, mixture [ of the dodecyl of dodecyl-pentadecyl methacrylate (DPMA), a straight chain, and branched chain, tridecyl, tetradecyl and pentadecyl methacrylate ]; and lauryl-millimeter still methacrylate (LMA) are mentioned especially.

[0017] Typically, as for "high cut" alkyl (meta) acrylate, an alkyl group has 16-24 carbon atoms. As suitable high cut alkyl (meta) acrylate, although hexadecyl methacrylate, heptadecyl methacrylate, octadecyl methacrylate, nona decyl methacrylate, KOSHIRU methacrylate, EIKO sill methacrylate, and such mixture are mentioned, it is not limited to these. Cetyl-EIKO sill methacrylate which is the mixture of hexadecyl, octadecyl, KOSHIRU, and EIKO sill methacrylate as especially useful mixture of high cut alkyl (meta) acrylate (CEMA); although the cetyl-stearyl metaacrylate (SMA) which is the mixture of hexadecyl and octadecyl methacrylate is mentioned to a list, it is not limited to these.

[0018] an above-mentioned MIDD0-cut -- and -- yes, - cut alkyl (meta) acrylate monomer is generally prepared by the standard esterification approach which used the long-chain fatty alcohol of reagent grade -- having -- these -- the alkyl group of available alcohol is 10-15 pieces or the mixture of various chain length's alcohol which it has 16-20 pieces about a carbon atom commercially. As an example of these alcohol, it is Vista. Chemical Various Ziegler catalyst-ized (Ziegler catalyzed) ALFOL alcohol from company, ALFOL1618 and ALFOL1620, Shell Chemical TA-1618 of Proctor&Gamble's and the alcohol of the natural product origin like CO-1270 are mentioned to various Ziegler catalyst-ized NEODOL alcohol from Company, i.e., NEODOL25L, and a list. [ i.e., ] Therefore, for the object of this invention, alkyl (meta) acrylate is meant with the thing also containing the mixture of the alkyl (meta) acrylate which each named alkyl (meta) acrylate product is not only included, but mainly contains the named specific alkyl (meta) acrylate.

[0019] In this invention, a useful alkyl (meta) acrylate monomer can be an independent monomer, or can be mixture with which the number of the carbon atoms of an alkyl part differs. Moreover, in this invention, useful acrylamide (meta) and a useful alkyl (meta) acrylate monomer can be permuted by arbitration. As the permutation (meta) acrylamide and the alkyl (meta) acrylate monomer of suitable arbitration, although hydroxy (C2-C6) alkyl (meta) acrylate, dialkylamino (C2-C6)-alkyl (meta) acrylate, and dialkylamino (C2-C6) alkyl (meta) acrylamide are mentioned, it is not limited to these. Especially a useful permutation alkyl (meta) acrylate monomer has one or more hydroxyls in an alkyl group, and hydroxyl is at least in beta- in an alkyl group especially (about 2-). The hydroxyalkyl (meta) acrylate monomer whose permutation alkyl group is the alkyl (C2-C6) of branched chain or a straight chain is desirable. As a suitable hydroxyalkyl (meta) acrylate monomer, although 2-hydroxyethyl methacrylate (HEMA), 2-hydroxyethyl acrylate (HEA), 2-hydroxypropyl methacrylate, 1-methyl-2-hydroxyethyl methacrylate, 2-hydroxy-propylacrylate, 1-methyl-2-hydroxyethyl acrylate, 2-hydroxy butyl methacrylate, 2-hydroxy butyl acrylate, and such mixture are mentioned, it is not limited to these. Suitable hydroxyalkyl (meta) acrylate monomers are HEMA, 1-methyl-2-hydroxyethyl methacrylate, 2-hydroxypropyl methacrylate, and such mixture. Generally the mixture of the two latter monomers is called "hydroxypropyl methacrylate" or "HPMA."

[0020] In this invention, as for other useful permutation (meta) acrylate and (meta) acrylamide monomers, an alkyl group has a dialkylamino radical or a dialkylamino alkyl group. As an example of such permutation (meta) acrylate and (meta) acrylamide Dimethylaminoethyl methacrylate, dimethylamino ethyl acrylate, N and N-dimethylaminoethyl meta-acrylamide, N, and N-dimethyl-aminopropyl meta-acrylamide, N and N-dimethylamino butyl meta-acrylamide, N, and N-G ethylamino ethyl meta-acrylamide, N and N-diethylamino propyl meta-acrylamide, N, and N-diethylamino butyl meta-acrylamide, N-(1 and 1-dimethyl-3-oxo-butyl) acrylamide, N-(1 and 3-diphenyl-1-ethyl-3-oxo-butyl) acrylamide, N-(1-methyl-1-phenyl-3-oxo-butyl) meta-acrylamide, And 2-hydroxyethyl acrylamide, N-meta-acrylamide of aminoethyl ethylene urea, Although such mixture is mentioned to N-METAAKURIRU oxy-ethyl morpholine, N-maleimide of dimethylamino propylamine, and a list, it is not limited to these.

[0021] In this invention as other useful permutation (meta) acrylate monomers gamma-pro PIRUTORI (C1-C6) alkoxy silyl (meth)acrylate, gamma-pro PIRUTORI (C1-C6) alkyl silyl (meth)acrylate, gamma-pro PIRUJI



(C1-C6) alkoxy (C1-C6) alkyl silyl (meth)acrylate, gamma-pro PIRUJI (C1-C6) alkyl (C1-C6) alkoxy silyl (meth)acrylate, BINIRUTORI (C1-C6) alkoxy silyl (meth)acrylate, BINIRUJI (C1-C6) alkoxy (C1-C6) alkyl silyl (meth)acrylate, Silicon content monomers including vinyl (C1-C6) ARUKOKISHIJI (C1-C6) alkyl silyl (meth)acrylate, BINIRUTORI (C1-C6) alkyl silyl (meth)acrylate, and such mixture are mentioned. As a vinyl aromatic series monomer useful as a partial saturation monomer in this invention, although styrene (STY), alpha methyl styrene, vinyltoluene, p-methyl styrene, ethyl vinylbenzene, vinyl naphthalene, vinyl xylenes, and such mixture are mentioned, it is not limited to these. Halogenated derivative; which the substitution product corresponding to the above-mentioned monomer is also contained as a vinyl aromatic series monomer, for example, contains one or more [ of a halogen radical like a fluorine, chlorine, or a bromine ] and nitroglycerine, cyano \*\* (C1-C10) alkoxy \*\* halo (C1-C10) alkyl, KARUBO (C1-C10) alkoxy \*\* carboxy, amino, an alkylamino (C1-C10) derivative, etc. are mentioned.

[0022] As a nitrogen content compound useful as a partial saturation monomer in this invention, and its thio-analog Vinylpyridines including 2-vinylpyridine or 4-vinylpyridine; A 2-methyl-5-vinyl-pyridine, 2-ethyl-5-vinylpyridine, 3-methyl-5-vinylpyridine, 2, a 3-dimethyl-5-vinyl-pyridine, And 2-methyl-3-ethyl-5-vinylpyridine The low-grade alkyl made into the start (C1-C8) permutation N-vinylpyridine; -- methyl-permutation quinoline and isoquinoline; -- N-vinyl caprolactam; -- N-vinyl butyrolactam; -- N-vinyl-pyrrolidone; -- vinyl imidazole; -- N-vinylcarbazole; -- N-vinyl-succinimide; -- Acrylonitrile; o-, m-, (Meta) or p-amino styrene; -- maleimide; -- N-vinyl-oxazolidone; -- N and an N-dimethylaminoethyl-vinyl ether; ethyl-2-cyanoacrylate; vinylacetone; N-vinyl phthalimide; N-vinyl-thio-pyrrolidone -- A 3-methyl-1-vinyl-pyrrolidone, a 4-methyl-1-vinyl-pyrrolidone, A 5-methyl-1-vinyl-pyrrolidone, a 3-ethyl-1-vinyl-pyrrolidone, A 3-butyl-1-vinyl-pyrrolidone, 3, and 3-dimethyl-1-vinyl-pyrrolidone, A 4, 5-dimethyl-1-vinyl-pyrrolidone, 5, and 5-dimethyl-1-vinyl-pyrrolidone, 3, 3, a 5-trimethyl-1-vinyl-pyrrolidone, a 4-ethyl-1-vinyl-pyrrolidone, N-vinyl-pyrrolidone; vinyl pyrroles including a 5-methyl-5-ethyl-1-vinyl-pyrrolidone and 3 and 4, and 5-trimethyl-1-vinyl-pyrrolidone; although vinyl aniline; and a vinyl piperidine are mentioned, it is not limited to these. as a permutation ethylene monomer useful as a partial saturation monomer in this invention -- an allyl compound monomer, vinyl acetate, a vinyl formamide, vinyl chloride, and a vinyl full ora -- although the id, a vinyl star's picture, vinylidene chloride, vinylidene fluoride, and a vinylidene star's picture are mentioned, it is not limited to these.

[0023] As a polymerization unit, it is desirable to include one or more [ of an aromatic compound ] about 3% of the weight at least, it is about 5 % of the weight at least preferably, and the polymer which can construct a bridge for this invention is about 10 % of the weight at least more preferably. Especially the polymer in which useful bridge formation is possible contains them in about 20% of the weight of an amount, even if there are few total amounts of a polymerization unit. It is more desirable that the polymer which can construct a bridge contains one or more [ of an aromatic aldehyde condensation product ]. Especially the polymer in which useful bridge formation is possible is a polymer which the Mw/Mn value of this aromatic aldehyde condensation product is at least 2.5 or more [ of other polymers including 1 or more (meta) and the acrylate polymer of an aromatic aldehyde condensation product ] including one, and is at least 3.0 preferably. It is still more desirable that the polymer which can construct a bridge for this invention does not have a sill phenylene group substantially, and it is more desirable not to have a sill phenylene group at all. Typically, the polymer which can construct a bridge exists in the constituent of this invention in the amount of about 60 - 85% of abbreviation of solid content, and are about 70 of solid content - 85% of abbreviation preferably.

[0024] In this invention, the catalyst of the useful cross linking agent is carried out from an acid, and it is the thing of the polymer which can construct a bridge, and the arbitration which constructs a bridge. As a suitable cross linking agent, G, tree, and tetrapod - or the polyfunctional ethylene nature partial saturation monomer beyond it is mentioned. In this invention as an example of a useful cross linking agent Trivinylbenzene, divinyl toluene, Divinyl pyridine, divinyl naphthalene, and divinyl xylene; and ethylene glycol diacrylate, Trimethylolpropane triacrylate, the diethylene-glycol divinyl ether, A TORIBI nil cyclohexane, allyl compound methacrylate (ALMA), Ethylene glycol dimethacrylate (EGDMA), diethylene glycol dimethacrylate (DEGDMA), Propylene glycol JIMETA acrylate, propylene glycol diacrylate, Trimethylolpropane trimethacrylate (TMPTMA), a divinylbenzene (DVB), Glycidyl methacrylate, 2,2-dimethyl propane 1, 3 diacrylate, 1, 3-butylene-glycol diacrylate, 1,3-butylene glycol dimethacrylate, 1,4-butanediol diacrylate, diethylene glycol diacrylate, Diethylene glycol dimethacrylate, 1,6-hexanediol diacrylate, 1, 6-hexanediol

dimethacrylate, tripropylene glycol diacrylate, Triethylene glycol dimethacrylate, tetraethylene glycol diacrylate, Polyethylene-glycol 200 diacrylate, tetra-ethylene glycol dimethacrylate, Poly ethylene glycol dimethacrylate, ethoxyl-ized bisphenol A diacrylate, Ethoxyl-ized bisphenol A JIMETA acrylate, polyethylene-glycol 600 JIMETA acrylate, Pori (butanediol) diacrylate, a pentaerythritol thoria chestnut rate, Trimethylolpropane triethoxyacrylate, glyceryl propoxy thoria KURIRETO, Pentaerythritol tetraacrylate, pentaerythritol tetramethacrylate, Dipentaerythritolmonohydroxypentaacrylate, a divinyl silane, A TORIBI nil silane, a dimethyl divinyl silane, divinyl methylsilane, A methyl TORIBI nil silane, a diphenyl divinyl silane, divinyl phenylsilane, TORIBI nil phenylsilane, a divinyl methylphenyl silane, a tetravinyl silane, Dimethyl vinyl disiloxane, Pori (methylvinyl siloxane), Pori (vinyl hydronalium siloxane), Although such mixture is mentioned to Pori (phenyl vinyl siloxane), tetrapod (C1-C8) alkoxy glycoluryl (for example, tetramethoxy glycoluryl and tetra-butoxy glycoluryl), and a list, it is not limited to these. Typically, the cross linking agent of this invention is used in the amount of about 5 - 25% of abbreviation of solid content, and are about 10 of solid content - 22% of abbreviation preferably.

[0025] In this invention, a free acid and an acid generator are mentioned as a useful acid catalyst. It is the constituent and compatibility of this invention and the free acid of arbitration which carries out the catalyst of the bridge formation of a cross linking agent to a polymer further fits the activity in this invention. As an example of a free acid, although sulfonic acids including methansulfonic acid, ethane sulfonic acid, a propyl sulfonic acid, a phenyl sulfonic acid, toluenesulfonic acid, dodecylbenzenesulfonic acid, and trifluoro methylsulfonic acid are mentioned, it is not limited to these. As an acid generator, a heat acid generator (TAG), photo-oxide generating agents (PAG), and such mixture are mentioned. The heat acid generator of arbitration and the photo-oxide generating agent of arbitration are useful in this invention. A heat acid generator is the compound of arbitration which separates an acid at the time of heat treatment. As a suitable heat acid generator, although 2, 4, 4, 6-tetrabromo cyclohexadiene-on, benzoin tosylate, 2-nitrobenzyl tosylate, the alkyl ester of other organic sulfonic acids, and the amine salt of a sulfonic acid are mentioned, it is not limited to these. Generally the compound which generates a sulfonic acid is suitable in the case of activation. A photo-oxide generating agent is a compound which separates an acid in the case of a photolysis. As a suitable photo-oxide generating agent, it is onium salt; 1 and 1-screw (p-chlorophenyl). - Although other photo-oxide generating agents indicated in this description for the activity in halogenation nonionic photo-oxide generating agent; and photoresist constituents including 2, 2, and 2-trichloroethane are mentioned, it is not limited to these.

[0026] Typically, an acid catalyst exists in the constituent of this invention in the amount of about 0.1 - 8% of abbreviation of solid content, and are about 0.5 of solid content - 5% of abbreviation preferably. In this invention, it is desirable that the mixture of an acid catalyst is used. As a suitable combination, the combination of a free acid and a photo-oxide generating agent and the combination of a free acid and a heat acid generator are mentioned. Generally such an acid catalyst is known, or is commercially available, and it can be used, without refining further. The constituent of this invention contains one or more solvents. The solvent of the arbitration which is compatibility is suitable for a compound. The solvent of low viscosity is desirable. As a suitable solvent, propylene glycol methyl ether acetate, 2-heptanone and ethyllactate; or 2-methoxy ethyl ether (jig lime), One or more [ of glycol ether including ethylene glycol monomethyl ether and propylene glycol monomethyl ether ]; Methoxybutanol, The solvent which has both the ether including an ethoxy butanol, methoxy propanol, and ethoxy propanol, and hydroxyl; Methyl-cellosolve acetate, Ethylcellosolve acetate, propylene-glycol-monomethyl-ether acetate, Ester including dipropylene-glycol-monomethyl-ether acetate and other 2 base ester; although a gamma-butyrolactone is mentioned to a propylene carbonate list, it is not limited to these. In this invention, especially a useful suitable solvent is a high-boiling point, i.e., a solvent which has at least preferably about 170 degrees C of about 190-degree C boiling points at least, comparatively. The mixture of a solvent can be advantageously used in this invention. Therefore, the solvent of this invention is mixable with other one or more solvents. Such other solvents may be any of a high-boiling point or a low-boiling point.

[0027] Although the constituent of this invention is not limited to arbitration by other one or more components and these, it can contain a plasticizer, a surface active agent, a leveling agent, a color, a pigment, a chromophore, etc., for example. It is added by the constituent of this invention and a plasticizer can improve the specific property of a constituent. As a suitable plasticizer, although 2 base ester including a dimethyl horse mackerel peat and dimethyl succinate is mentioned, it is not limited to these. The mixture of a plasticizer can be used in this invention. Typically, a plasticizer is used in the amount of about 0.5 - 10% of abbreviation of solid

content, and are about 1 of solid content - 5% of abbreviation preferably. It is desirable that one or more plasticizers are used in the constituent of this invention. It is recognized by this contractor that a lot of plasticizers like [ to 100% of - abbreviation ] can be advantageously used in this invention to about 50 of solid content.

[0028] It sets to this invention and is Union as an advantageous leveling agent. Surface leveling agents including what is available as a trade name Silwet7604 from Carbide, or 3M The available surfactant FC430 is mentioned from Company. Selection and the amount of such a leveling agent are the matter of this contractor's capacity within the limits. The constituent of this invention can also function as antireflection coating. For example, when the polymer and/or cross linking agent which can construct a bridge contain an aromatic series radical, such a constituent can be used as an acid-resisting constituent for a 193nm radiation. In another mode, copolymerization or by mixing, it can be added by the constituent of this invention and a color or a chromophore can offer a useful acid-resisting constituent in the radiation of other wavelength.

[0029] 1 or more [ of the desiccation component in a solvent, i.e., the polymer for which a bridge can be constructed, ], 1 or more [ of an acid catalyst ], and 1 or more [ of a cross linking agent ] concentration changes according to various factors like the application approach. Generally, the solid content content of the constituent of this invention is about 0.5 - 25% of the weight of the AUW of a constituent, and changes preferably in about 2 - 20% of the weight of the range of the AUW of a constituent. The constituent of this invention is prepared by mixing a component in order of arbitration. Especially, as a constituent of suitable this invention, the polymer which can construct a bridge is an aromatic aldehyde condensation product, and it is dodecylbenzenesulfonic acid (blocked) with which the acid catalyst was blocked, and it is tetra-butoxy glycoluril preferably and tetramethoxy glycoluril or tetra-butoxy glycoluril, and the constituent whose solvent is propylene-glycol-monomethyl-ether acetate further are mentioned for a cross linking agent.

[0030] The constituent of this invention is useful although flattening of the front face of bases including an electron device is carried out substantially. Although a semiconductor device like the wafer especially used in manufacture of a printed wired board, a conductor, and a semi-conductor as a useful base is mentioned, it is not limited to these. The constituent of this invention can be applied to a base and flattening can be carried out with the various means of arbitration including spin coating. When applied to a base, the constituent of this invention offers coating or the layer deposited on the front face of a base. When a constituent is applied to a thing like a semi-conductor wafer by spin coating, the thickness of the film obtained can be controlled to be set to less than about 200Å - about 1.5 micrometers. One or more [ of the polymer / molecular weight / for which this invention can construct / whose a Mw/Mn value it is 8000 or less and is at least 1.5 / a bridge ] It is a constituent containing 1 or more [ of an acid catalyst ], 1 or more [ of a cross linking agent ], and 1 or more [ of a solvent ]. The polymer in which this bridge formation is possible as a monomeric unit Said constituent of further the polymer for which this hydroxyl can construct [ this ] a bridge which is about 3 % of the weight at least including the monomer which has at least one hydroxyl The method including the process which hardens this constituent selectively at least by heating this base at sufficient temperature to make it deposit on the front face of a base, and harden this constituent selectively at least to; pan of offering on a base the front face by which flattening was carried out substantially locally is offered.

[0031] Drawing 1 is the sectional view of Bahia 12 in the layer 10 which has aperture deposited on the base 16, it fills up with this Bahia thoroughly with the constituent 14 of this invention, and this constituent 14 forms the front face by which carried out the overcoat of the layer 10 which has aperture, and flattening was carried out substantially. The base by which flattening was carried out substantially means the base which has the aperture with which it filled up substantially. The aperture "with which it filled up substantially" has the aperture restoration ratio (aperture fill ratio; AFR) of about 2 - abbreviation 100. Formula A/B defines for the aperture which AFR has a larger aspect ratio than 2, and has the size of 0.5 micrometers or less preferably, A is the height of the constituent for aperture restoration within aperture among a formula, and B is the film of the constituent for aperture restoration on the front face of the layer which has aperture, or the thickness of a layer. This relation is further shown in drawing 2, and drawing 2 is the sectional view of Bahia 12 in the layer 10 which has the aperture arranged on a base 16, and it fills up with this Bahia substantially with the constituent 14 of this invention. Above-mentioned AFR can be determined about the aperture with which it filled up thoroughly as shown in drawing 1, or the aperture with which it filled up selectively as shown in drawing 2.

[0032] Typically, about 75 degrees C - about 250 degrees C of constituents of this invention are preferably

hardened selectively at least by being heated at the temperature of about 90 degrees C - about 225 degrees C. It says "it hardens selectively at least" and that the constituent for aperture restoration is constructing the bridge about 10% at least. As for the constituent for aperture restoration, it is more desirable that a bridge is constructed over a bridge being constructed substantially preferably and thoroughly. The constituent of this invention can be hardened by covering the base covered with this constituent over one step or 2 step BEKU. 1 step BEKU is sufficient temperature to construct a bridge substantially preferably selectively at least in the constituent of this invention, and time amount, and heats this constituent. By the exception method, although 2 step BEKU can be used and this 2 step BEKU is not enough to harden the constituent of this invention, this constituent is heated at the 1st temperature which can be made to be able to carry out a reflow of this constituent, and can raise flattening, then this constituent is heated by the 2nd sufficient temperature and time amount to construct a bridge substantially preferably selectively at least. When 2 step BEKU is used, as for the base containing the constituent of this invention, AFR is preferably heated at least 15% at least 10% by temperature and time amount which increase at least 25% more preferably.

[0033] One or more [ therefore, / of the polymer / weight average molecular weight / for which this invention can construct / whose a Mw/Mn value it is 8000 or less and is at least 1.5 / a bridge ] It is a constituent containing 1 or more [ of an acid catalyst ], 1 or more [ of a cross linking agent ], and 1 or more [ of a solvent ]. The polymer in which this bridge formation is possible as a polymerization unit Said constituent of further the polymer for which this hydroxyl can construct [ this ] a bridge which is about 3 % of the weight at least including the monomer which has at least one hydroxyl The front face on a base which heats this base at 1st sufficient temperature to make it deposit on a base and carry out a reflow of the; this constituent,; Ranks second, and includes the process which heats this base at 2nd sufficient temperature to harden this constituent and by which flattening was carried out substantially locally is also offered. As for a base, it is desirable to have one or more aperture.

[0034] Such a process produces the base which has the polymer film, coating, or the layer over which the bridge was constructed and which has the front face by which flattening was carried out substantially. This film as a polymerization unit 1 or more [ of the polymer which can construct a bridge ], and 1 or more [ of a cross linking agent ] are included. The polymer in which this bridge formation is possible 8000 or less weight average molecular weight, And it has the Mw/Mn value of at least 1.5, and the polymer in which this bridge formation is possible has the monomer which has at least one hydroxyl as a polymerization unit, and further, this hydroxyl is about 3 % of the weight, even if there are few polymers in which this bridge formation is possible. This invention is useful especially although Bahia is protected in the dual DAMASHIN process in semi-conductor manufacture to offering the front face by which flattening was carried out substantially locally, and coincidence. Therefore, this invention is a base which has aperture and the constituent containing the polymer by which the bridge was constructed over this aperture is included. 1 or more [ of the polymer over which the this polymer over which the bridge was constructed can construct a bridge as a polymerization unit ], and 1 or more [ of a cross linking agent ] are included. The polymer in which this bridge formation is possible has 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5. The base which has said aperture of the polymer over which this hydroxyl can further construct a bridge which is about 3 % of the weight at least including the monomer in which the polymer in which this bridge formation is possible has at least one hydroxyl as a polymerization unit is offered.

[0035] In a dual DAMASHIN process, first, aperture including Bahia is formed in bases including a dielectric layer, antireflection coating is applied to arbitration, subsequently, a photoresist layer is applied, pattern attachment of the trench is carried out, a resist is exposed and developed, and a trench is etched further. In such a process, if the bottom product of aperture is not protected, it may receive breakage. This invention has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5. It is a constituent for aperture restoration containing 1 or more [ of the polymer which can construct a bridge ], 1 or more [ of an acid catalyst ], 1 or more [ of a cross linking agent ], and 1 or more [ of a solvent ]. It has the monomer in which the polymer in which this bridge formation is possible has at least one hydroxyl as a polymerization unit. Further the polymer for which this hydroxyl can construct [ this ] a bridge is about 3 % of the weight at least. The approach of protecting the bottom product of aperture in the manufacture including the process heated to sufficient temperature to make said constituent for aperture restoration deposit on the front face of a base, and harden this constituent for this base to; pan of an electron device is offered.

[0036] The dual DAMASHIN process is important in manufacture of a semiconductor device. One or more [ of this 1st aperture ] is selectively filled up with the constituent for aperture restoration at least. therefore, this invention -- a base -- the 1st two or more aperture -- providing --;b -- this constituent One or more [ which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 / of the polymer for which a bridge can be constructed ] The polymer in which this bridge formation is possible contains the monomer which has at least one hydroxyl as a polymerization unit including 1 or more [ of an acid catalyst ], 1 or more [ of a cross linking agent ], and 1 or more [ of a solvent ]. Are said constituent for aperture restoration which is about 3% of the weight over which this hydroxyl can further construct a bridge of a polymer, and a;c this base is heated. this constituent is hardened selectively at least -- making --;d -- the 2nd aperture which connects two or more [ of the 1st aperture with which it filled up selectively at least ] -- plasma etching -- carrying out --; -- further -- e -- this constituent hardened selectively at least -- this -- the process removed from the 1st two or more aperture is included -- The approach of manufacturing an electron device is offered. In such a dual DAMASHIN process, as for a process, it is desirable to include further the process which makes antireflection coating deposit on the front face of the constituent for aperture restoration, and it is more desirable to make a photoresist deposit on the front face of this antireflection coating. Subsequently, before etching, actinic rays are used for a photoresist and it is exposed. In such a process, it is still more desirable that the plasma-etching rate of the constituent for aperture restoration and a base conforms substantially.

[0037] When the aperture restoration matter of this invention is plasma-etching-proof nature too much, i.e., being slowly etched rather than the matter which has aperture like a dielectric layer, while etching a trench, a problem arises. When the matter 20 which has aperture is etched about such a case and it forms a trench 22, "a fence (fence)" or the ORGANO metallic (organometallic) polymer residue 24 with it difficult [ to remove ] adjoins the matter 26 for aperture restoration, and produces drawing 3 . Such a fence 24 has the case in the copper 28 of a dual pellet syn conformation object as shown in drawing 4 where it remains after metalization.

[0038] By fitting substantially the plasma-etching rate of the matter for aperture restoration to the plasma-etching rate of the layer which has the aperture of a base, formation of such a fence is reduced or it is removed. The plasma-etching rate of the constituent for aperture restoration of this invention can be adjusted by adjusting the ratio to the non-aromatic series radical of the aromatic series radical in this constituent. For example, the plasma-etching rate of this matter increases by reducing the content of the aromatic series radical in the matter. Therefore, for application which requires that the plasma-etching rate of the aperture restoration matter should be more high, it is desirable to reduce the amount of the aromatic series radical in the polymer or cross linking agent in which it is possible, the content of the aromatic series radical in a constituent is reduced, for example, bridge formation. Such reduction of an aromatic compound content can be easily attained by using an aliphatic compound instead of an aromatic compound. Therefore, the plasma-etching rate of a constituent increases by replacing an aromatic series monomer by the aliphatic series monomer. For example, in manufacture of the semi-conductor using a dual DAMASHIN process, it is desirable that the plasma-etching rate of the constituent for aperture restoration suits substantially the plasma-etching rate of the layer which has aperture including a dielectric layer. As for "the plasma-etching rate which suited substantially", the plasma-etching rate of the matter which has aperture means that it is the etching-proof nature large twice from about 1 rather than the plasma-etching rate of the constituent for aperture restoration. As for the plasma-etching rate of the constituent for aperture restoration of this invention, it is desirable that it is 1 to 2 twice [ which has aperture ] the plasma-etching rate of the matter. When it fits substantially the plasma-etching rate of the layer which has a constituent for aperture restoration, and aperture, the content of the aromatic series radical of the polymer in the constituent for aperture restoration for which a bridge can be constructed is low, for example, it is preferably desirable that an aromatic series radical is not included substantially more preferably less than about 5% of the weight less than about 10% of the weight.

[0039] One or more [ therefore, / which has about 8000 or less weight average molecular weight and the Mw/Mn value of at least 1.5 on the front face of the base with which this invention has aperture in a layer / of the polymer for which a bridge can be constructed ] It is the constituent for aperture restoration which contains one or more [ of a solvent ] in 1 or more [ of an acid catalyst ], and or more 1 list of a cross linking agent. The polymer in which this bridge formation is possible contains the monomer which has at least one hydroxyl as a polymerization unit. The polymer for which this hydroxyl can construct [ this ] a bridge is about 3 % of the weight at least. At least one of the polymer in which this bridge formation is possible, and these the cross



linking agents contains an aromatic series monomer as a polymerization unit. At least one of the polymers and these cross linking agents in which this bridge formation is still more possible Process; and the base which contain an aliphatic series monomer as a polymerization unit and on which said constituent for aperture restoration is made to deposit The process which heats this constituent at sufficient temperature for making it harden selectively at least is included. The plasma-etching rate of; this constituent for aperture restoration, The approach of protecting the bottom product of the aperture in manufacture of an electron device that the plasma-etching rate of the layer which has this aperture conforms substantially is offered.

[0040] moreover, the base which has one or more aperture in a layer according to this invention -- it is -- this -- said base with which the etch rate of the polymer over which the bridge was this constructed, and the etch rate of the layer which has aperture conform substantially is offered including the constituent for aperture restoration with which one or more aperture contains the polymer over which the bridge was constructed. Although this invention is indicated about manufacture of a semi-conductor, this invention is recognized to be what can be used in a wide range application object. It is recognized that this invention is also useful to comprehensive flattening of a base. The following example means illustrating the further various modes of this invention, and does not mean limiting the range of this invention in any modes.

[0041] The compound for example 1 aperture restoration is metacresol-Para-cresol. - 2, 5-dimethoxy phenol novolak polymer (the propylene-glycol-monomethyl-ether acetate (PGMEA) solution of solid content 21.118g 30%) As a Mn800 and Mw2500g/mol, Tg83 degree C, a Para-toluenesulfonic acid mono-hydrate (5.02% solution in PGMEA, 1.125g, 0.5 % of the weight of solid content), and a cross linking agent They are FC430 (more nearly available (inside of PGMEA 1%) than 3M company) (g [ 0.337 ], 0.05% of solid content), and a dimethyl horse mackerel peat (although it is the 5% of the total solid content) as tetramethoxy glycoluril (0.748g, 15% of solid content), and a surface activity leveling agent. It was prepared by being contained in count of solid content, twisting and mixing 0.323g and PGMEA26.32g (26.321g). This prepared the 50g sample at 15% of solid content. a compound is enough to dissolve the matter -- a period roll should be carried out and let the 0.2-micron Pori (tetrafluoroethylene) (PTFE) filter pass before an activity -- it passed.

[0042] This solution is 3000rpm, and it was designed so that 3000A film thickness might be produced on a title after BEKU. This solution was applied on the wafer by which pattern attachment was manually carried out so that it might have Bahia of various sizes with a depth of about 1 micrometer. Subsequently, the wafer rotated by 3000rpm, then, subsequently was first heated for 60 seconds at 205 degrees C for 60 seconds by 90 degrees C. Although it had the same size of 250nm, Bahia separated in the different consistency or different pitch all over a field was estimated by the scanning electron microscope (SEM). Drawing 5 is SEM of Bahia with which it filled up which has the pitch of 1:1. Drawing 6 is SEM of Bahia with which it filled up which has the pitch of 1:3. Drawing 7 is Bahia which has the pitch of 1:6 and with which it filled up (isolated). These data have the gap-filling property excellent in this compound, and show an over filling (overfill), i.e., carried out the overcoat and thoroughly filled up with Bahia, a little about the structure evaluated.

[0043] The 2 para-toluenesulfonic acid of examples was replaced with 25% solid content solution in the ISO-propanol of blocked 0.479g dodecylbenzenesulfonic acid (Nacure 5225 [ available from King Industries, Norwalk, and Connecticut ]) as a heat acid generator, and the approach of an example 1 was repeated except for the weight of the component of further others having been changed. the :metacresol-Para-cresol -2 whose used compound is as follows, and 5-dimethoxy phenol novolak polymer (30% solid content solution in PGMEA --) dodecylbenzenesulfonic acid (25% solid content solution in ISO-propanol --) blocked 33.581g As 0.479g, 1% of solid content, tetramethoxy glycoluril (1.800g, 15% of solid content), and a leveling agent FC430 (1% solution in PGMEA,g [ 0.603 ], 0.005% of solid content), a dimethyl horse mackerel peat (it does not contain in calculation of 0.528g, 5% of solid content, and solid content), and the remainder are PGMEA(s).

[0044] The approach of an example 2 was repeated except for the example 3 tetramethoxy glycoluril cross linking agent having been permuted by tetra-butoxy glycoluril. therefore, the :metacresol-Para-cresol -2 whose compound was as follows and 5-dimethoxy phenol novolak polymer (30% solid content solution in PGMEA --) dodecylbenzenesulfonic acid (25% solid content solution in ISO-propanol --) blocked 301.268g and 75.95% of solid content 9.520g, 2% of solid content, tetra-butoxy glycoluril (26.180g) They are 22% of solid content, FC430 (1% solution in PGMEA,g [ 5.950 ], 0.05% of solid content), a dimethyl horse mackerel peat (it does not contain in calculation of 5.950g, 5% of solid content, and solid content), and 322.512g PGMEA. This prepared the 700g sample at 17% of solid content. The sample was diluted by less than 10% of solid content, and the spin



coat was carried out on the wafer which has Bahia with a depth of 1 micrometer (3000rpm). Subsequently, the wafer was heated for 60 seconds at 205 degrees C. Although it filled up with Bahia isolated for the lower solid content content substantially, it filled up with Bahia in the field of dense structure selectively.

---

[Translation done.]

**\* NOTICES \***

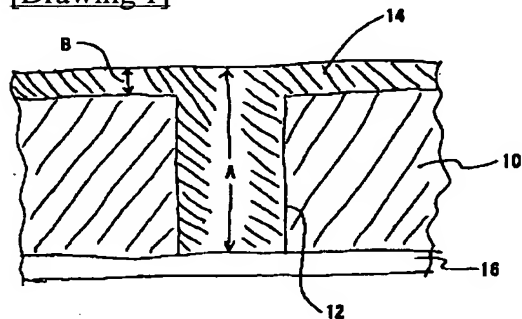
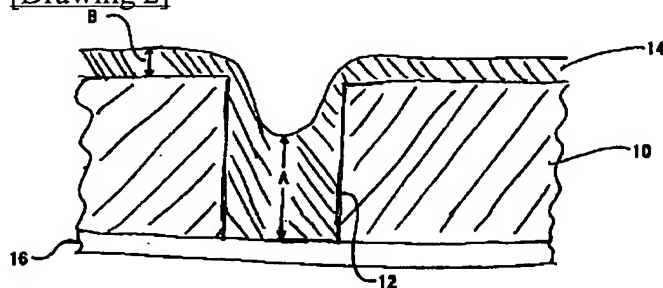
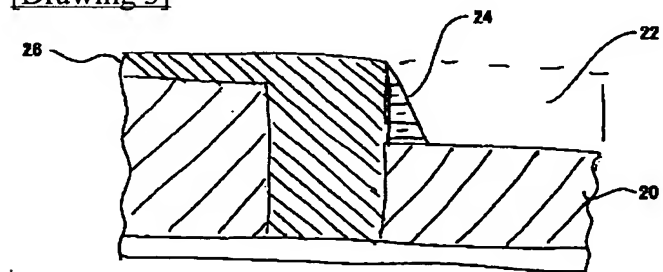
JPO and NCIPi are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**DRAWINGS**

---

[Drawing 1]**図 1**[Drawing 2]**図 2**[Drawing 3]**図 3**[Drawing 4]

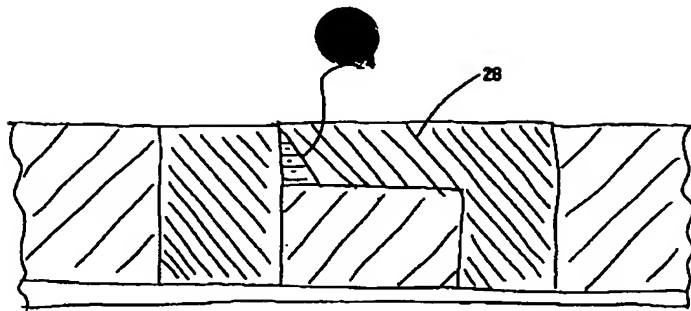


図 4

[Drawing 5]

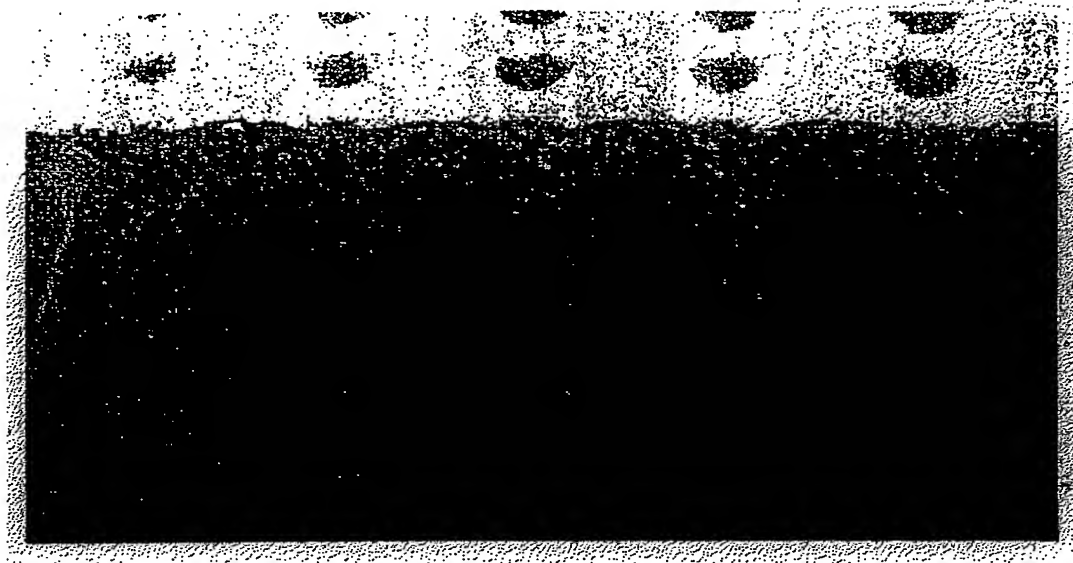


図 5

[Drawing 6]

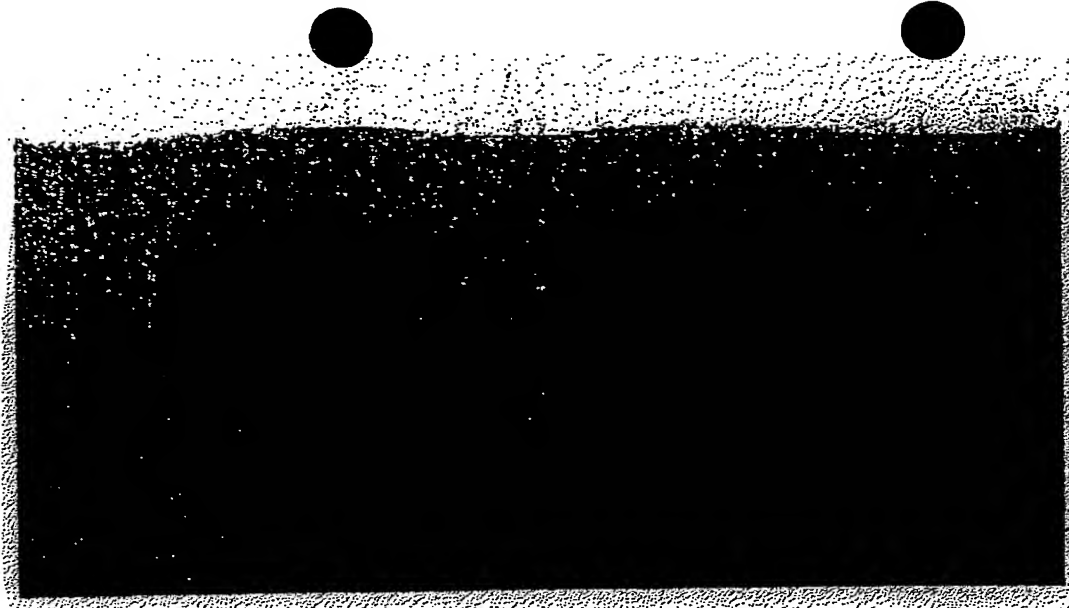


図 6

[Drawing 7]



図 7

---

[Translation done.]

**This Page is Inserted by IFW Indexing and Scanning  
Operations and is not part of the Official Record**

**BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ **BLACK BORDERS**
- ☐ **IMAGE CUT OFF AT TOP, BOTTOM OR SIDES**
- ☐ **FADED TEXT OR DRAWING**
- ☐ **BLURRED OR ILLEGIBLE TEXT OR DRAWING**
- ☐ **SKEWED/SLANTED IMAGES**
- ☐ **COLOR OR BLACK AND WHITE PHOTOGRAPHS**
- ☐ **GRAY SCALE DOCUMENTS**
- ☐ **LINES OR MARKS ON ORIGINAL DOCUMENT**
- ☐ **REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY**
- ☐ **OTHER:** \_\_\_\_\_

**IMAGES ARE BEST AVAILABLE COPY.**

**As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.**